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SAFETY EVALUATION REPORT

To Resolve Three Issues that Caused Revocation of Certificate of Compliance for 5320 Package

Docket No. 90-13-5320

Transportation and Packaging Safety Division, EH-33.3
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1.0 General Information

1.1 Introduction

The certificate of compliance of the 5320 package has been suspended pending resolution of three issues that have raised questions about the validity of the tests that were used to in the development of the Safety Analysis Report. To resolve these issues, a supplement, revised, to the Safety Analysis Report has been prepared which consists of a brief description of the actions that have been taken and a number of supporting Westinghouse Savannah River Company internal memorandum which provide details of the testing and analyses that have been performed.

Since the package design has been modified, the following evaluation of the safety of this package has been approached as a review of a modified design rather than a review of the satisfactory resolution of the three issues. This was considered necessary to avoid the possibility of a modification resolving one of the issues while compromising the previous review in another area.

1.2 Issues to be Resolved

A previous review of the Safety Analysis Report for the 5320 package had identified three issues which were sufficient cause for suspension of the Certificate of Compliance for this package. These issues are as follows:

Issue 1

The buna-N O ring and the Flexitallic gasket in the EP-62 containment vessel flange must be tested independently after package loading; however, the package design does not allow for independent testing of these seals.

Issue 2

Previous testing of the 5320 package did not demonstrate containment following the hypothetical accident sequence for the EP-62 containment vessel.

Issue 3

Stresses in the weld that forms the primary seal in the EP-61 containment vessel exceeded the values allowed by Regulatory Guide 7.6.

The resolution of these issues has resulted in modifications to the package design followed by retesting of the package to assure its ability to endure the hypothetical accident test sequence. The following sections describe the modifications to the package and review the tests that have been performed to demonstrate compliance with the requirements of 10CFR71.

1.3 General Description of Package

The process of resolving the issues resulted in several modifications to the design of the 5320 package which are intended to improve its ability to contain the radioactive material while enduring the rigors of the hypothetical accident. The modifications are tabulated as follows.

5320 Design Modifications

1. A "top-hat" impact limiter consisting of a pipe cap welded to a section of pipe replaced the torroidal impact limiter.
2. Grade 8 machine screws and nuts are used to attach the top-hat rather than the lower grade machine screws that were used to attach the torroidal impact limiter.
3. Threads were removed from the aluminum flange for the attachments of the top-hat to permit the use of machine screws and nuts rather than threaded inserts.
4. The expanded metal personnel access cover was modified to permit access to insert the nuts that are required to attach the top-hat impact limiter.
5. A grade 8 machine screw is used for the base plate attachment rather than the lower grade machine screw previously specified.
6. A section of 3x5 stainless steel channel was added to the base plate where the machine screw penetrates the base plate.
7. Vent holes were added to the aluminum tank walls. These holes are fitted with plastic plugs which will melt or be forced out by gas pressure during a fire accident.

EP-62 Design Modifications

1. Annular groove and test port added to top flange between the sealing surfaces for the O ring and the Flexitallic gasket.
2. Gasket sealing surface on the top flange and in the gasket grooves on the bottom flange were changed from a finish of 32 microinches to 80 to 125 microinches.
3. Flexitallic gasket grove depth was reduced from 0.096/0.100 inches to 0.092/0.095 inches by machining the surface of the bottom flange.
4. The Flexitallic gasket was changed to a Flexitallic gasket with a higher density.

5. A removable thermal shield was attached to the lower flange.
5. Washers were added to the closure bolts.

EP-61 Design Modifications

1. One silicone O ring in the cap was replaced by a stainless steel ring.
2. A second cap was allowed which does not have a step-down in the wall leading to the seal weld lip.

While all of these modifications are important to the ability of the package to perform its function, the most important modifications are the addition of a groove and test port between the two seals on the EP-62 containment vessel, removal of one O ring from the EP-61 containment vessel, and the addition of the "top-hat " impact limiter and vent holes in the aluminum tank of the 5320 package. The test port on the EP-62 containment vessel permits independent testing of the buna-N O ring and the Flexitallic gasket. Removal of the O ring from the EP-61 containment vessel dramatically reduces the pressure buildup within this vessel during the hypothetical fire accident. The vent holes in the aluminum tank of the 5320 package permits the gases that result from the decomposition of the Water Extended Polyester to escape from the package and transport heat away from the containment vessels.

2.0 Review of Materials of Fabrication and Construction

2.1 Introduction

The materials of construction of the 5320 package and the EP-61 and EP-62 containment vessels have not been changed as a result of the design modifications that are being review here. However, where new parts have been added to the design, their materials of construction will be reviewed.

The "top-hat" impact limiter which provides protection for the closure of the EP-62 vessel is fabricated from grade 304L stainless steel which is a well characterized material that needs no further characterization in this supplement. These parts are fabricated from a 6 inch long section of 12 inch diameter schedule 20 pipe and an end cap of a 12 inch diameter schedule 10 pipe.

The plug that closes the holes in the lower portion of the shell of the package is a commercial plastic product which is not characterized in the supplement to the Safety Analysis Report; however, its function is to soften or melt during the fire which is reasonably assured for any material that is characterized as a plastic.

Upgrading the bolts that attach the impact limiter to the body of the package and the machine screws that attach the lower plate to the body of the package does not represent a change of materials.

2.2 Package Contents

The package contents have not been changed by the modifications to the package.

3.0 Review of Structural Evaluation

3.1 Introduction

The design modifications that are significant to the structural analysis of the 5320 package are the addition of the "top-hat" impact limiter and the addition of the section of channel to the base plate. The "top-hat" impact limiter provides protection for the top of the EP-62 containment vessel during any impact on the upper surfaces of the package by transferring the impact loads to the aluminum tank which is sufficiently strong to absorb impact loads. The channel that is attached to the lower plate, provides protection for the bolt that secures the EP-62 containment vessel inside the 5320 package. The channel is intended to sacrificially protect the bold during impact loading, particularly during the impact on the 6 inch diameter pin.

A 5320 package was subjected to a sequence of tests that duplicated the regulatory tests indicated in 10CFR71.73(c)(1) and 10CFR71.73(c)(2). No testing or analysis was provided to demonstrate satisfaction of the regulations during normal transport conditions; however, the modifications were primarily directed at improving the performance of the package during the hypothetical accident. The results of reviews of the modified package design are presented in the following paragraphs.

3.2 Areas of Review

The modified design of the 5320 package and its containment vessels was reviewed to assure satisfaction of the requirements of 10CFR71. The review concentrates upon deformations that could impact the sealing capacity of the containment vessels.

3.3 Hypothetical Accident Conditions

This review confirms that the structural design of the modified 5320 packaging uses acceptable test methods and complies with all relevant DOE orders and 10CFR71 regulations. The test representing the hypothetical accident was observed for the two drop cases, which are a 30 foot drop onto an essentially unyielding surface and a subsequent 40 inch drop onto a 6 inch diameter pin.

The structural modifications to the package, except for the small changes near the Flexitallic gasket, were observed to have been performed. The function of the structural modifications were reviewed and understood as to their expected behavior in the normal and accident conditions. Many of the preparatory steps in the assembly of the package to be dropped were observed. The loading and assembly of the 5320 container was observed to be performed according to the test procedure and represented a package ready for shipment. Test procedures were reviewed to cover all of the steps that were not observed directly and to review again those steps that were observed.

There is concurrence that the worst case orientations for damage during the drop tests are the ones that were selected based upon preliminary tests. There is concurrence that the two successive drops caused no significant structural damage that would effect containment. This conclusion is substantiated by the successful conclusion of the leak rate detection measurement after the furnace test in July 1991, as presented in Section 4.4. This review therefore verifies that the modified 5320 package was appropriately subjected to the structural tests (hypothetical accident conditions) as specified in 10CFR71.73(c)(1) and 10CFR71.73(c)(2).

3.4 Normal Conditions of Transport

The modifications to the 5320 package design has been considered to have no impact on package performance for normal conditions of transport. The design modifications primarily increased the strength of the package or fasteners for normal transport conditions. For example, the use of grade 8 machine screws and nuts to attach the "top-hat" impact limiter is a superior design to the previous attachment which relied on machine screws that engaged threads in the aluminum top plate. Consequently, the previous review of this package remains applicable.

3.5 Review of Seal Weld on EP-61 Containment Vessel

This report confirms that the structural pressure analysis of the modified 5320 packaging, specifically the EP-61 vessel, uses acceptable analytical methods and complies with all relevant DOE and 10CFR71 regulations. The dimensions and the materials used in the EP-61 were reviewed and found to be acceptable. The structural loads for the linear elastic analysis as described in Ref. 2 were clearly defined to be a scaleable 1000 psi internal pressure and thermal differentials due to the active fuel contents. The finite element modeling of the pressure loaded EP-61 vessel is assessed as adequate. The stress analysis conducted in Ref. 20 was performed in compliance with the applicable ASME Code, Section III. The stress intensities in the analysis are acceptable. The computer program used in the analysis, ANSYS, is an acceptable analysis code that has been extensively benchmarked and has an industrial history of being adequate for linear elastic analyses. The analysis is noted as being conservative in that the threads were not included in the model. The linearization that is needed to obtain the primary membrane plus bending stress intensities which are reported in Ref. 20 are not explained but are judged to be reasonable accurate in that the reported stress intensities are near the peak stress intensities that are shown in the accompanying figures.

As part of this review, a confirmatory analysis was performed to assess the adequacy of the analysis in Ref. 20. The geometry of the EP-61 was finely discretized as shown in Fig. 1. The discretization in the finite element mesh around the weld is also shown in Fig. 1. This geometry is the same as that in Ref. 20 with the exception that the small taper at the top of the longer part of the EP-61 was omitted. Also, the lower half of the EP-61 (where there is no significant stress response) has been eliminated. The omission of the taper is considered to be inconsequential. The boundary conditions consist of axially restrained nodes on radial rollers at the lowest axial position. In addition, radially restrained nodes on axial rollers were specified on all nodes on the longitudinal axis of the EP-61. A uniform pressure of 800 psi was applied on the interior boundary of this model including the inside of the cap and the region between the body and cap adjacent to the seal weld. The material properties (elastic modulus and Poisson's ratio) of the stainless steel 316 were taken from the ASME Boiler and Pressure Vessel Code, Section III, Appendix 1 at a temperature of 800°F.

The computer program NIKE2D (Ref. 28) was used to perform the analysis and to obtain displacement and stress results. The displacement results are shown in Fig.2 where the deformation have been magnified by a factor of 1000 for illustrative purposes. The displaced result is observed to be qualitatively in the same shape as that shown in Ref. 20. Contours of stress intensity are shown in Fig. 3, where a peak stress intensity value of 24,000 psi was obtained. Contours of hoop stress are shown in Fig. 4, where a peak hoop stress of 7,300 psi was obtained. Even though no linearization was performed on the NIKE2D stress results, it is expected that the resulting values would be nearly equal to the peak stress results noted above. The peak stresses are comparable in magnitude and location to those presented in Ref. 20.

This report there verifies that the pressure analysis of the EP-61 container is adequate and demonstrates that the seal weld will be capable of providing containment during the hypothetical accident.

3.6 Findings

This review has confirmed that the 5320 package was subjected to the impact portions of the hypothetical accident as specified in 10CFR71 and that the deformations would not adversely effect the performance of the seals. The analysis of the EP-61 containment vessel seal weld also confirmed the adequacy of this weld to maintain containment during normal transport and hypothetical accident conditions.

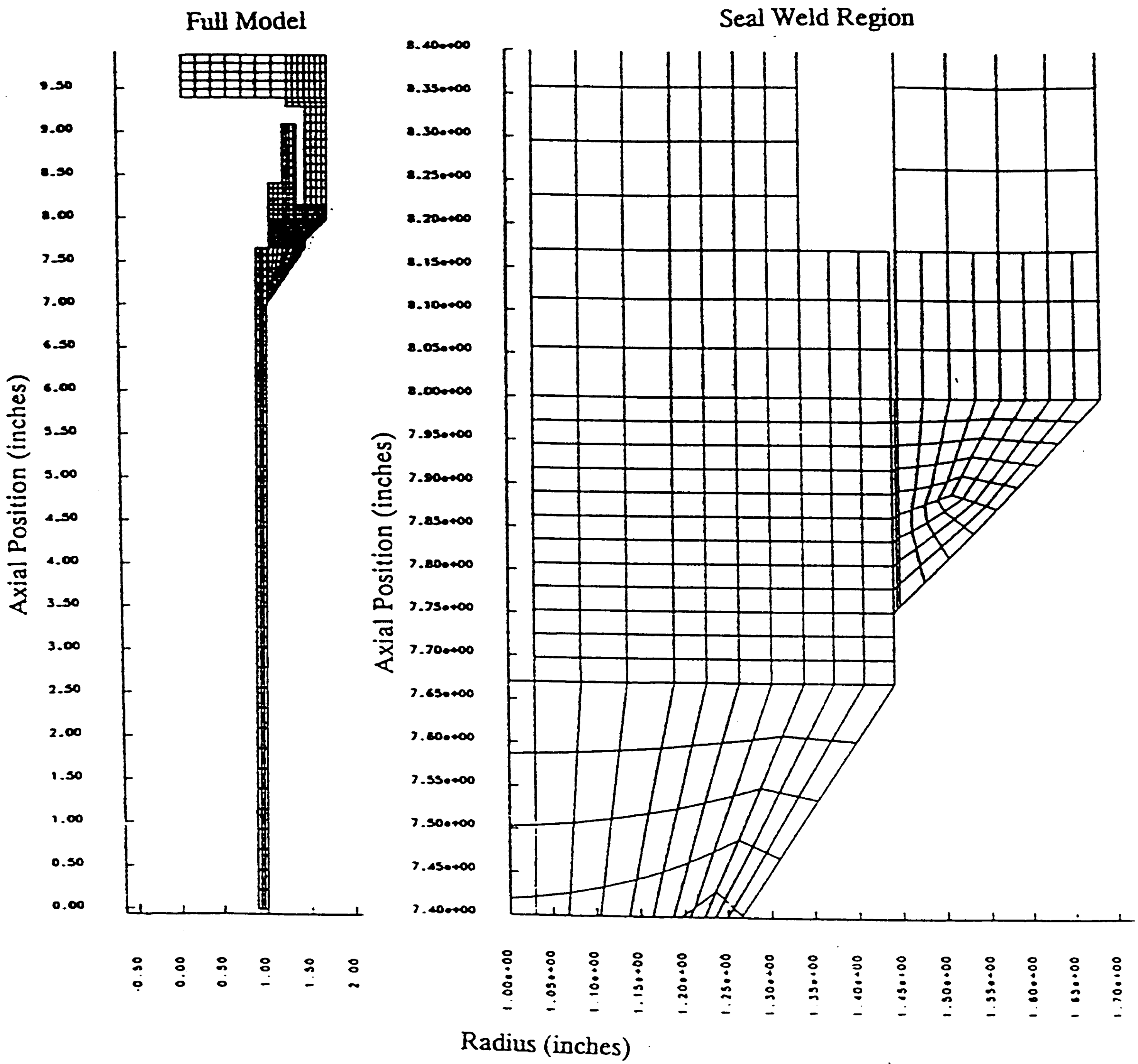

Figure 1. Mesh used in confirmatory evaluation of the EP-61 seal weld

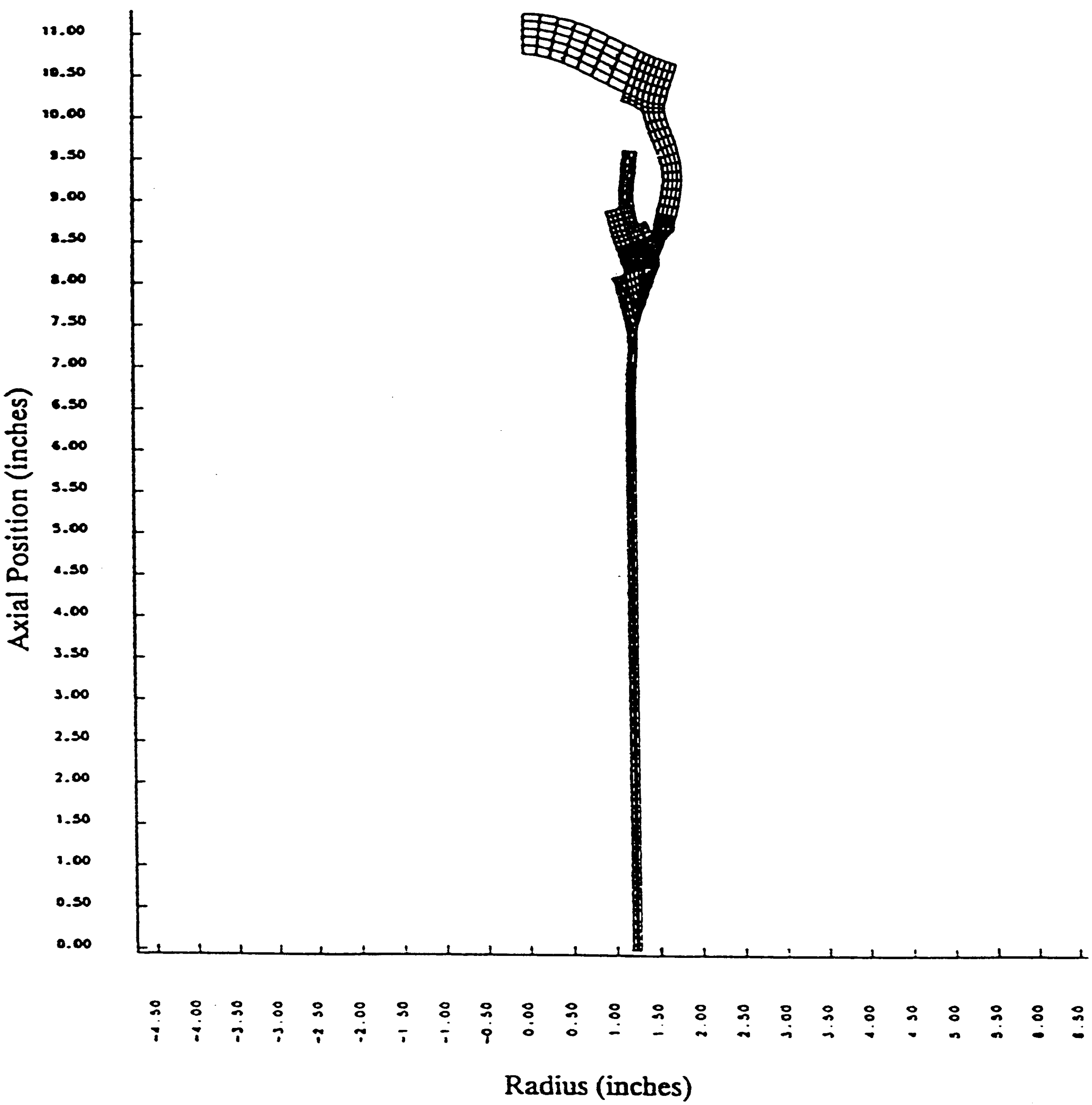

Figure 2. Magnified deformations resulting from the confirmatory evaluation of the EP-61 seal weld

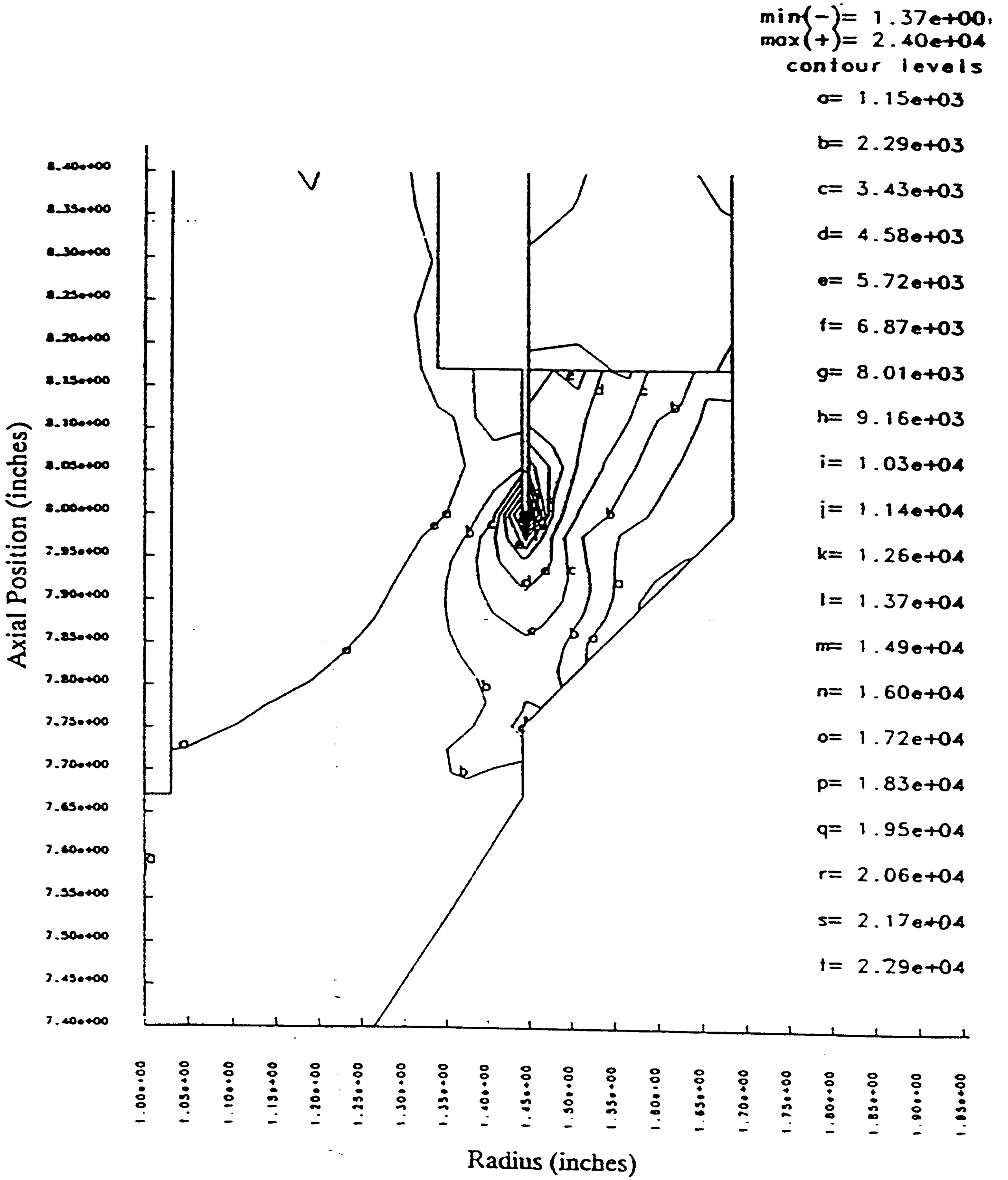

Figure 3. Stress intensity contours resulting from the confirmatory evaluation of the EP-61 seal weld

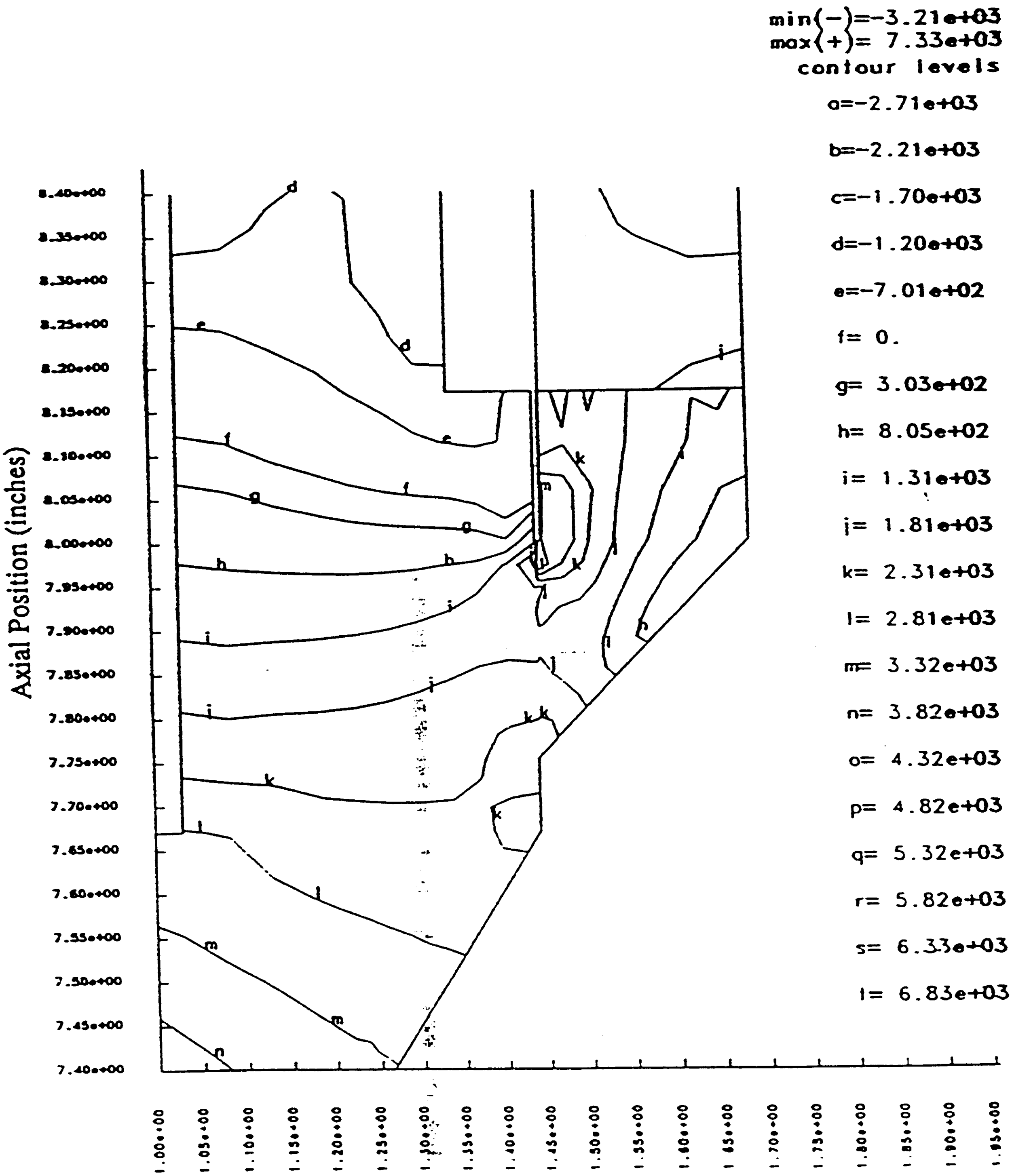

Figure 4. Hoop stress contours resulting from the confirmatory evaluation of the EP-61 seal weld

4.0 Review of Thermal Evaluation

4.1 Introduction

The design modifications of the 5320 package that are significant to the thermal performance are the addition of the "top-hat" impact limiter and the introduction of vent holes in the aluminum tank. The "top-hat" impact limiter was essentially undamaged during the impact portions of the accident so it is equivalent to a fin that absorbs heat and conducts the heat into the top of the aluminum tank. The vent holes allow the gases produced during the decomposition of the Water Extended Polyester (WEP) to escape during the hypothetical fire accident which transports heat from the inside of the aluminum tank to the outside of the aluminum tank. The other design modifications were minor from a thermal point of view and do not materially impact the thermal review.

The 5320 package and the EP-61 and EP-62 containment vessels were subjected to a series of thermal tests that approximated to various degrees the hypothetical thermal accident to demonstrate compliance with the requirements of 10CFR71. Satisfaction of the requirements for normal transport conditions was demonstrated by a conservative analytical modeling of the package. The results of the reviews of this package design are presented in the following paragraphs.

4.2 Areas of Review

The review of the modified 5320 package encompassed the performance of the seals of the EP-61 and EP-62 containment vessels during normal transport and hypothetical accident conditions. The review of normal transport conditions focused upon the upper bound of the ambient conditions because the allowable temperature for the seals is below the minimum ambient temperature.

4.3 Normal Conditions of Transport

The temperature distribution within the EP-61 and EP-62 containment vessels within the 5320 package were computed by Westinghouse Savannah River Co. for normal conditions of transport. The key features of the model were the treatment of all air gaps within the package and the WEP as absolute insulators and the elimination of radiation heat transfer at the outer surface of the package. Based upon this model, the temperatures at the center of the contents was maximized because realistic heat flow paths were discounted. The computed temperatures at the locations of the seals in the EP-61 and EP-62 containment vessels are presented in Table 1 and compared to the limiting temperatures for the appropriate type of seal. In all cases, the computed temperatures are well below the allowable temperature for the seal.

Table 1. Seal Temperatures for Normal Operation

Containment Vessel	Seal	WSRC Computed Temperature (°F)	Bounding Temperature Predicted by Review	Temperature Limit Max. (°F)	Min (°F)	
EP-61	Weld	349		Unlimited		
EP-62	buna-N O Ring	154	225	250	-45	(1)
	Flexitallic	154	225	860	NA	(2)
		154	225	540	NA	(3)

Notes: (1) Parker O-Ring Handbook for nitrile O-Rings

(2) Flexitallic Gasket Company, manufacture's data for service in air, minimum service temperature not indicated.

(3) Flexitallic Gasket Company, manufacture's data for service in any reducing or inert medium (such as helium), minimum service temperature not indicated.

However, the model employed by WSRC under estimates the temperature of the seals in the EP-62 because it does not allow any heat transfer from the top of the EP-61 to the EP-62 flange region. Radiation and convection heat transfer will occur in this region. The temperatures in the flange region of the EP-62 have been computed as part of this review by assuming one dimensional heat transfer (in the radial direction) from the surface of the EP-61, across the gap between the EP-61 and EP-62, through the flanges, across the gap between the EP-62 and the top-hat, through the top-hat, and from the top hat to the environment. Both radiation and convection were included in each of the gaps as well as at the outer surface of the top-hat. The temperatures resulting from this simplified representation of the flange region of the EP-62 are presented in Figure 1. The most important result of this calculation is the temperature in the vicinity of both seals in the EP-62 flange is approximately 225°F. This simplified model ignores any flow of heat from the flange of the EP-62 into the aluminum tank that is the major heat transfer mechanism in the remainder of the package, so the temperatures predicted by this simplified model represent over-estimates of the temperature. Consequently, the temperature in the vicinity of the seals will be less than 225°F which is below the reported temperature limit for extended periods. Similarly, the Flexitallic gasket will be below its temperature limit if exposed to air and will be well below its temperature limit if only exposed to helium.

4.4 Hypothetical Accident Conditions

Four different tests of the 5320 package have been performed by Westinghouse Savannah River Company to demonstrate the ability of this package to endure the hypothetical fire accident following the hypothetical free fall and puncture tests. The key features of this package are Flexitallic gasket in a stainless steel bolted flange of the EP-62 containment vessel along with a seal weld on the EP-61 containment vessel. These seals provide excellent capability to withstand high temperatures without compromising its containment function. Additionally, the aluminum fins and tank and Water Extended Polyester (WEP) are intended to be sacrificial components which melt or decompose to absorb heat while protecting the containment vessels.

The four series of thermal tests include:

(1) a furnace test of the 5320 package with the hole in the bottom of the aluminum tank and WEP filled with a stainless steel rod (WSRC-IOM,SRL-PTG-91-0040),

(2) a furnace test of the modified production packages including open holes in the aluminum tank which exposed WEP to the environment (WSRC-IOM,SRL-PTG-91-0042), and

(3) an engulfing pool fire with the package inverted to permit the top hat to fall off when the aluminum begins to melt, and

(4) a partially engulfing pool fire with the package inverted; however, unexpected winds caused a portion of the package to be exposed to fire conditions that did not reach the regulatory conditions.

Leak tests at the conclusion of the first test demonstrated that containment was maintained after the falls. However, the furnace test was judged to not meet the intent of 10CFR71 so a pool fire test was required to demonstrate that containment was maintained after the hypothetical fire. The first pool fire test completely engulfed the package for the entire thirty minutes and the flame temperatures were well in excess of 800°C for the entire fire. However, the tophat impact limiter fell off the package approximately 19 minutes after the start of the package and the top of the EP-62 was exposed directly to the flames. This softened the steel to the point that containment was lost so the test was a failure. The second pool test was an engulfing fire for the first four to five minutes but then wind developed which caused the package to be partially outside the column of flames; however, the presence of a thermal shield over the top of the EP-62 protected the EP-62 from excessive temperatures and the leakage tests showed that containment had been maintained. All tests were very severe and could have satisfied the requirements of 10CFR71.73(c)(3); however, this cannot be proven due the unpredictability of the decomposition of the WEP and the transport of the decomposition gases.

The fourth test was compromised by the presence of wind (velocity about 2.5 meters/sec) after four of five minutes of the test had elapsed. The configuration of the flames is indicated in Fig. 6 which is a photograph of the package in the fire that was taken from the north side of the fire test. The sloped flame front is clearly visible and the package is clearly exposed. This type of condition was present during most of the final 20 to 25 minutes of the fire.

A series of calculations was performed to assess the impact of the reduced flame temperature on the temperatures experienced by the package during the fire test. An infinitely long cylinder of aluminum was exposed to a radiant heat source at a temperature of 800°C for a thirty minute period. The results of these calculations are presented in Fig. 7 and Fig. 8. Fig. 7 presents three curves, one each for the center of a region exposed to a flame temperature of 1000°C and the center of a region exposed to a flame temperature of 700°C. The third curve is the time history of the temperature at the interface between these two regions. Fig. 8 represents the repeat of this calculation with the entire flame temperature at 800°C. All of these curves approach the flame temperature at about ten minutes after the start of the analysis and all of these curves approach the melting temperature of aluminum at five to eight minutes after the start of the analysis.

The melting of the aluminum fins, tank, and the support for the top hat impact limiter are also indicators of the intensity of the heat that reached the containment vessel. During both pool fire tests the top hat impact limiter clearly separated from the remainder of the package and splashed into the water approximately 19 minutes after the start of the fire. This was visible and audible by the observers of the fire test even though they remained at a safe distance.

Based upon these two approaches to the evaluation of the fire test, it can be concluded that the wind had very little impact on the fire and the heat transfer to the containment vessels in the 5320 package was equivalent to a fire that met the regulatory conditions.

The only valid measure of performance of a package is the ability to maintain containment following the hypothetical accident sequence. Consequently, the leakage rate of the EP-62 containment vessel was measured before and after the each of the fire and furnace tests. In each case, the measured leakage rate was substantially below the acceptable leak rate.

4.5 Findings

The review of the design modifications for the 5320 package indicates that the thermal design features will assure compliance with the performance requirements of 10CFR71.

The analytical evaluation of normal conditions of transport does not result in temperatures that exceed the allowable temperatures for any of the containment seals or any of the significant components of the package. The tests that represent the hypothetical thermal accident have been judged to reproduce the conditions required by 10CFR71.73(c)(3). So the sequence of tests that was performed indicates that the thermal performance of the 5320 package meets or exceeds the performance requirements of 10CFR71 and containment will be provided during and following the hypothetical thermal accident.

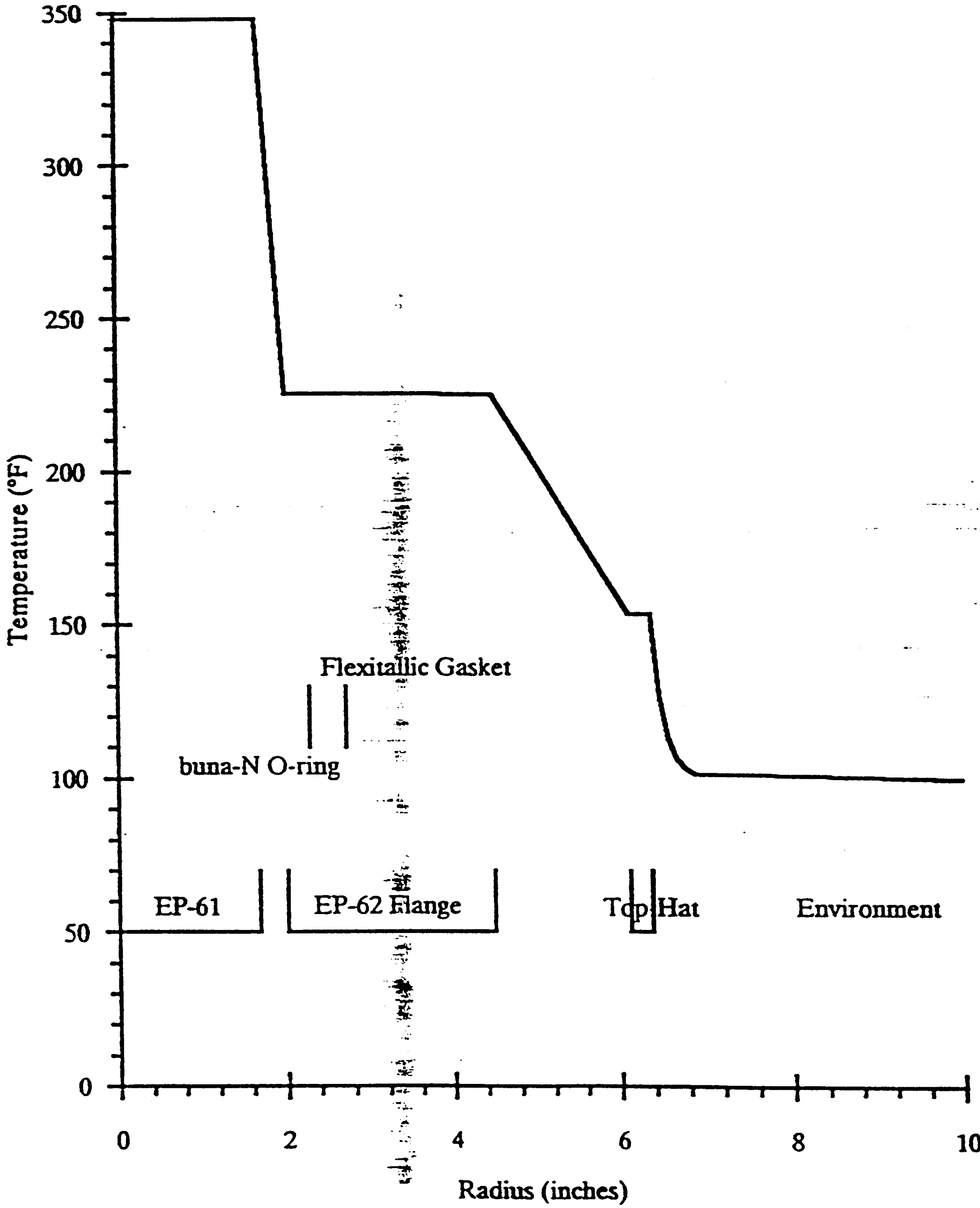

Figure 5. Temperatures predicted in simplified, one-dimensional model of flange of EP-62.

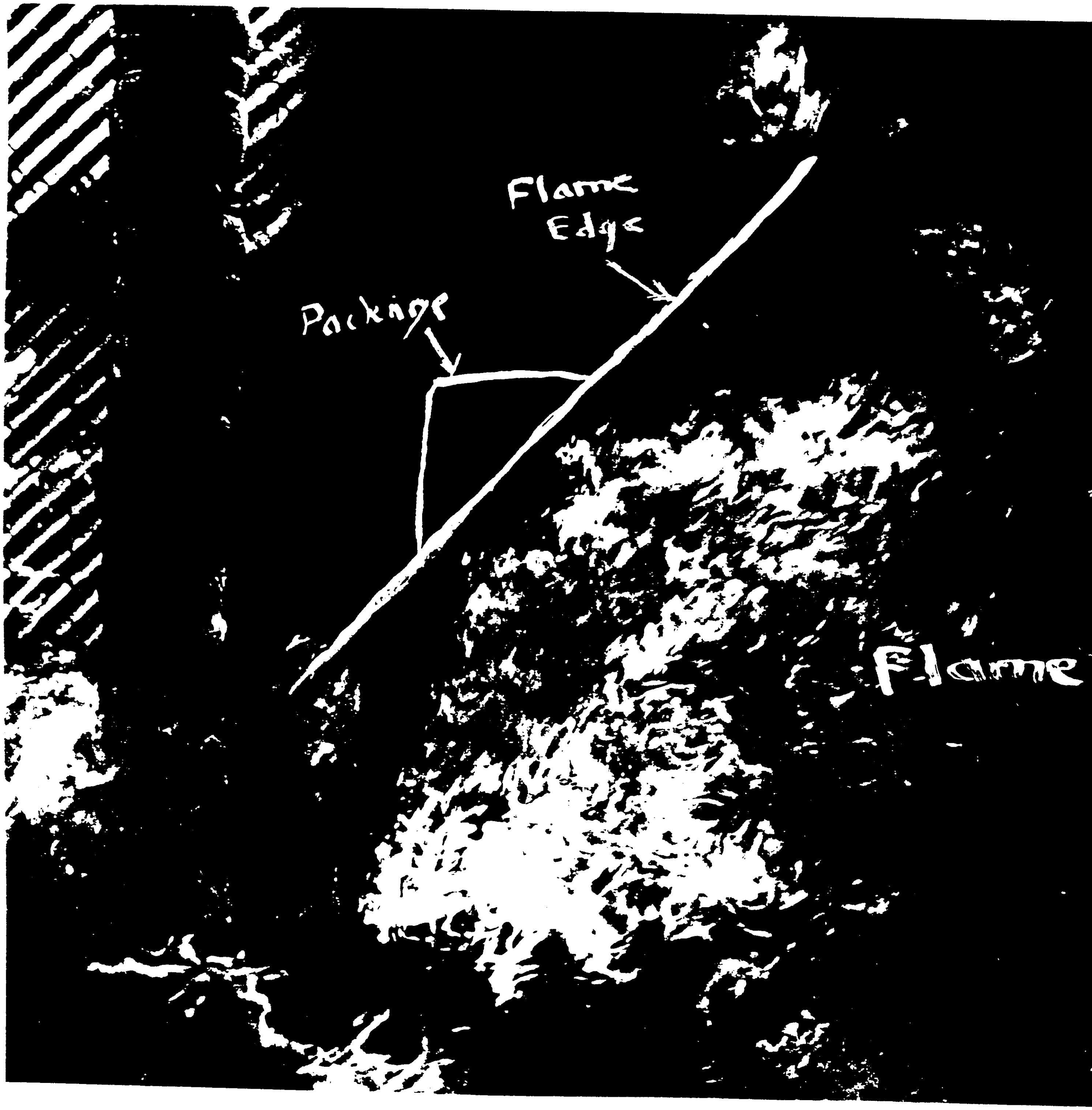

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Figure 6. Flames during pool fire test of inverted 5320 package.

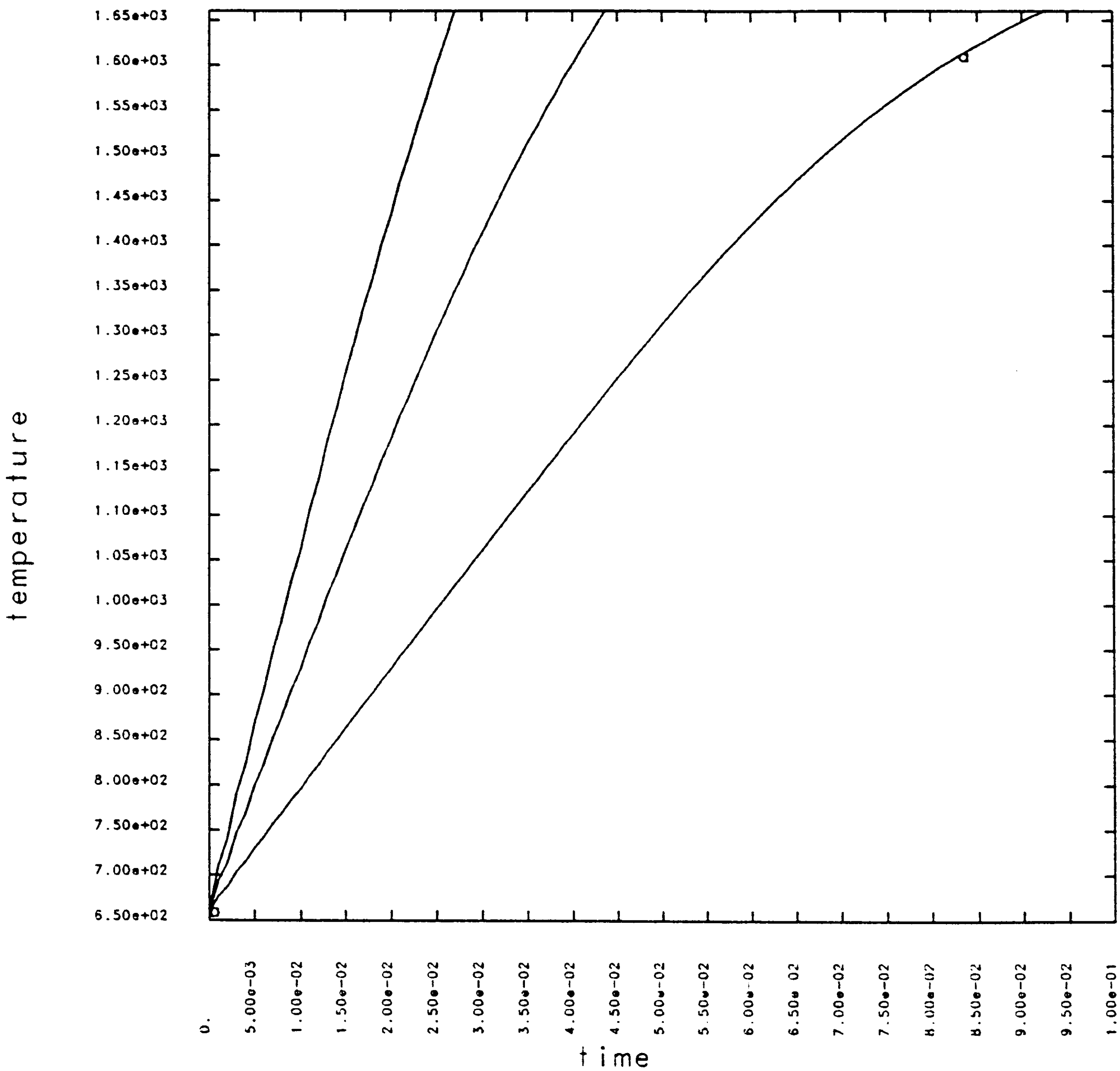

Figure 7. Temperatures in aluminum ring exposed to nonuniform fire.

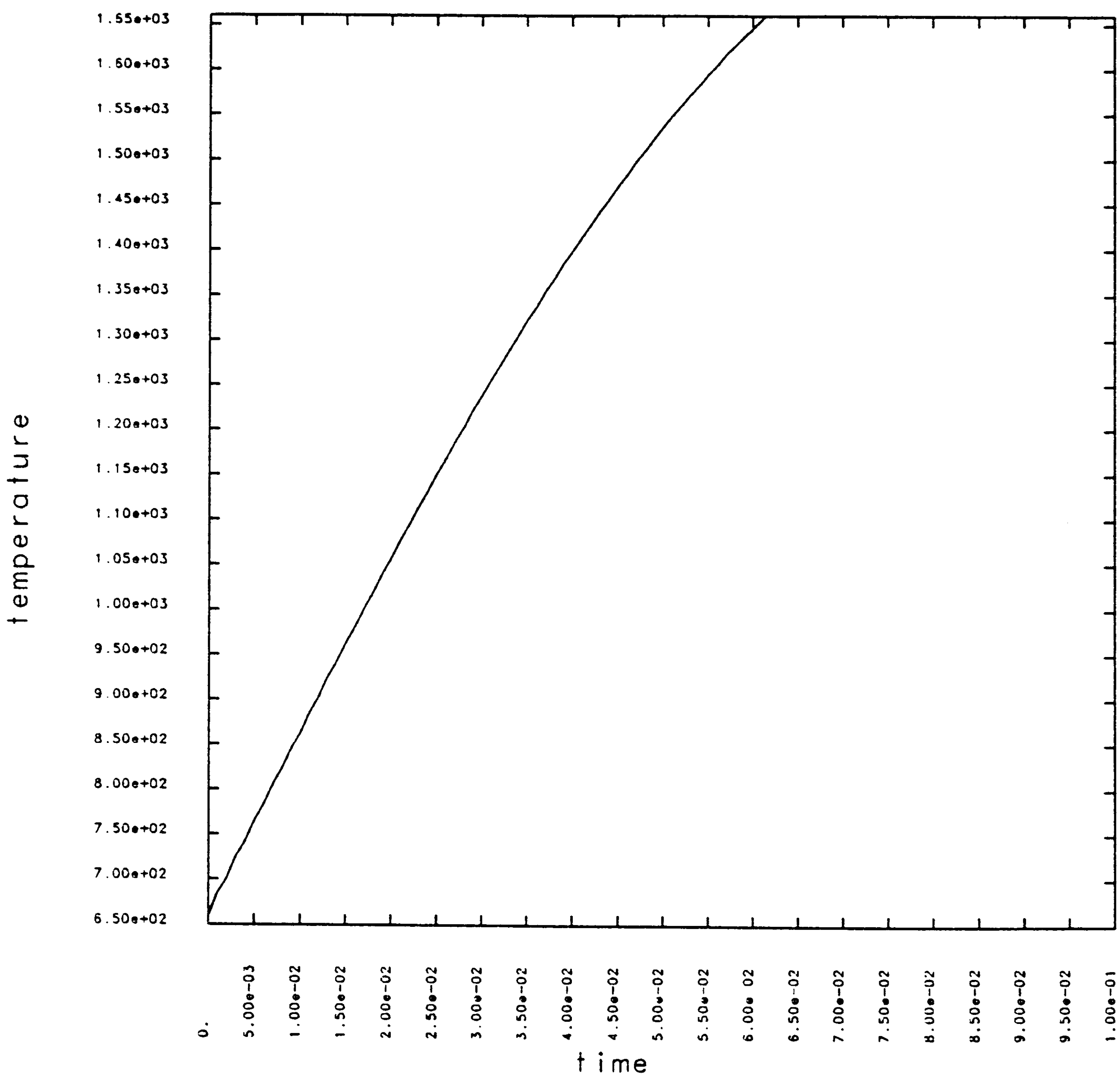

Figure 8. Temperatures in aluminum ring exposed to regulatory fire.

5.0 Review of Containment Evaluation

5.1 Introduction

The purpose of this section is to review the modifications to the design of the 5320 packaging as they pertain to containment. The changes that are significant to containment are as follows:

1. An annular groove was added to the top flange face with a test port extending to the flange surface. The groove lies on the O-ring and gasket seal median, allowing independent leak testing of both seals.
2. The gasket sealing surface finish on the top flange face was changed from a uniform roughness of 32 AA microinches to 80 to 125 AA microinches. This enhanced gasket sealing.
3. The gasket groove depth was changed from 0.096/0.100 to 0.092/0.095 inches. The increased gasket compression improved sealing performance.
4. A higher density gasket was specified, resulting in a better seal than the previously specified gasket.

5.2 Areas of Review

The design, as modified, has been reviewed for compliance with 10CFR71, Regulatory Guide 7.4 and ANSI Standard N14.5.

5.3 Containment Boundaries

Because the 5320 is used to ship plutonium, two independent containment boundaries are required. These are provided by the EP-62 containment vessel and the EP-61 containment vessel. In addition a third layer of containment in the form of an EP-60 product container is provided. However, the EP-60 is not considered to be a part of the containment.

The EP-62 containment vessel consists of an upper and a lower unit bolted together. Continuity of the containment boundary between these two units is maintained by two independent seals, a buna-N O-ring is effective during normal conditions of transport and satisfies the appropriate leakage criteria and a Flexitallic™ metal graphite seal remains effective during the entire hypothetical accident sequence and satisfies the appropriate leakage criteria. Independent leak test capability for each of the two seals is provided by two penetrations through the upper unit. For the buna-N O-ring, the leak test penetration is centered on the top of the upper unit. For the Flexitallic gasket, the leak test penetration is through the flange. Leak test procedures examine the leakage rates through the buna-N O-ring, through the Flexitallic gasket, and through both test ports to insure that the containment boundary for the EP-62 can be maintained at all times during shipment.

The EP-61 consists of a three piece assembly. The body of the containment vessel accepts a screwed plug inside the open end of the vessel and a second screwed on cap that closes the open end of the vessel. The containment boundary is maintained through the use of a seal weld around the periphery of the screwed on cap. The EP-61 containment vessel, therefore, has no penetrations.

5.4 Procedures

The leak test procedures for the 5320 consist of four individual leak tests. The first for the buna-N O-ring which has an allowable leak rate of $1.0x10^{-7}$ std cc/sec air ($1.97x10^{-7}$ std cc/sec He). The second leak test applies to the Flexitallic gasket, which has an allowable leak rate of $1..0x10^{-4}$ std cc/sec air ($1.97x10^{-4}$ std cc/sec He). The third and fourth tests are for the two leak test port plugs located on the EP-62 body. Both of these tests have an allowable leak rate of $1.0x10^{-7}$ std cc/sec air ($1.97x10^{-7}$ std cc/sec He).

A review of the individual leak test procedures suggests that each has been planned to meet or exceed the requirements of ANSI N14.5 and that the results obtained from the tests should be reliable.

5.5 Findings

The modifications to the design of the 5320 have been reviewed to determine that the containment design changes are in compliance with the requirements of 10CFR71, Regulatory Guide 7.4, and ANSI N14.5.

Basis for acceptance in the review has been conformance with established guidelines and criteria. The evaluation of the containment design changes provides reasonable assurance that, under normal conditions of transport and/or hypothetical accident conditions, it will be possible to transport radioactive material safety.

The staff concludes that the protective features provided in the design modifications conforms to applicable Regulations, Regulatory Guides and industry standards, and are acceptable.

6.0 Review of Shielding Evaluation

The modifications to the 5320 package have no impact on the shielding that is provided by during normal transport conditions. The addition of vent holes to the aluminum tank reduces the loss of Water Extended Polyester (WEP) during the hypothetical fire test hence the shielding performance is improved following the fire accident. Since the previous package design had been reviewed and found to satisfy the regulations, the revised package design also satisfies the regulatory requirements.

7.0 Review of Criticality Evaluation

The requirement that the package maintain its contents in a subcritical configuration has not been effected by the design modifications. Consequently, the modified package satisfies the regulatory requirements.

8.0 Review of Operating Procedures

The operating procedures for the 5320 package have been modified only in the area of leak testing prior to release for transport. The leak testing of the seals was reviewed in Section 5.0 and found to be satisfactory to demonstrate the proper assembly of the EP-61 and EP-62 containment vessels and their respective seals. Consequently, the operating procedures satisfies all of the appropriate regulations.

9.0 Review of Acceptance Tests and Maintenance Program

There have been no changes in the acceptance tests or maintenance program as a result of the modifications to the package.

10.0 Review of Quality Assurance Requirements

There have been no changes in the quality assurance program as a result of the modifications to the package.

11.0 References

1. DPSPU 79-124-1, Rev. 1, "Safety Analysis Report - Packages Pu Oxide and Am Oxide Shipping Cask", Final report revised December 1989, Compiled by G. G. Chalfant.

2. Memorandum, Jacques Read, Acting Director Division of Quality Verification and Transportation Safety, to W. A. Richardson, DOE/SR, "Removal of USA/5320/B()F, Pu-Oxide and Am-Oxide Shipping Cask from Service", dated September 20, 1990.

3. SRS drawing W2021341, Rev. 1, "EP-2 Secondary Containment Vessel Details".

4. SRS drawing S5-2-10251, Rev. 32, "SP 5320, Assemblies No. 2 and 3 Assembly".

5. SRS drawing S5-2-9465, Rev. 43, "SP 5320, Detail Sheet #1".

6. SRS drawing S5-2-9464, Rev. 12, "SP 5320, Detail Sheet #3".

7. SRS drawing S5-2-9995, Rev. 65, "EP 61 Primary Containment Vessel, Assembly and Details".

8. SRS drawing W2022070, Rev. 1, "SP 5320, Structural Protection Parts, Details".

9. WSRC-IOM, SCS-CMAS-910033, "Temperature Profile of the 5320D Shipping Cask Under Normal Operating Conditions", 6/24/91, J. Jerrell to M. Whitney.

10. WSRC-IOM, SCS-CMAS-910037, "Description of P/Thermal Software", 6/30/91, J. Jerrell to M. Whitney.

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